K-1436PC1

PATENT

In the application of: Mehrotra et al.
Serial No. 10/606,482
Filed: June 26, 2003

RESPONSE TO FINAL OFFICE ACTION OF NOVEMBER 15, 2007

REMARKS

Introduction

This paper is responsive to the pending final Office Action mailed November 15, 2007 in the above-captioned patent application. By this paper, applicants have amended claim 25 to narrow the temperature range for the step of heat treating the ground ceramic cutting insert. This amendment defines the claims so as to overcome the rejection under 35 USC §112¶1st and the rejections over prior art. Applicants' relevant arguments are set froth below.

Applicants submit that this paper fully responds to the pending final Office Action. Further, applicants point out with appreciation that claim 55 stands allowed, but still solicit the allowance of the other pending claims.

Rejection of Claims 25-34 and 57 under 35 USC §112¶1st

Claims 25-34 and 57 stand rejected under 35 USC §112¶1st because the claims allegedly contain subject matter not described in the specification so as to reasonably convey to one skilled in the art that applicants possessed the invention as of the filing date. Applicants disagree with his rejection for the reasons set forth below.

In reference to claim 25, the limitation, "... greater than 1400 degrees Centigrade ..." has been amended to read, "... about 1600 degrees Centigrade ...". The lower limit of 1600 °C finds support in the examples cited in the Response mailed on September 4, 2007. In light of the amendment, the examples are not "several hundred degrees higher than 1400", but are close to the limit of 1600 °C. In this regard, Mixture V, Mixture VI, and Mixture VII disclose a temperature equal to 1650 °C. These examples clearly allow persons of ordinary skill in the art to recognize that applicants invented what is claimed by the claims. See MPEP 2163.02, pages 2100-185 through 2100-186, Rev. 6 (Sept. 2007).

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In reference to claim 57, the specification presents an example, i.e., Mixture VI, Table II, which falls within the limitations of claim 57. As a consequence, applicants submit that the requirements of the written description requirement are satisfied in this case. MPEP 2163.02, pages 2100-185 through 2100-186, Rev. 6 (Sept. 2007).

Applicants respectfully request the removal of this rejection.

Rejection of Claims 25-28 and 31-34 under 35 USC §103(a) over Jindal et al. as Evidenced by Suzuki

The Examiner rejects claims 25-28 and 31-34 under 35 USC §103(a) over Jindal et al. as evidenced by Suzuki (U.S. Patent No. 5,168,080). Applicants disagree with the rejection for the reasons set forth below.

Claim 25 recites the step of, "... heat treating the ground ceramic cutting insert at a temperature between about 1600 degrees Centigrade and about 2200 degrees Centigrade so as to form the heat treated ground ceramic cutting insert." The specification is clear that one goal of the present invention is to produce an improved ceramic cutting insert (see page 2, line 37 through page 3, line 7 of Serial No. 10/606,482):

> There also remains as an objective the production of ceramic cutting inserts (e.g., silicon nitride-based cutting inserts, SiAlON-based cutting inserts, alumina-based cutting inserts, titanium carbonitride-based cutting inserts, and whisker-reinforced ceramic cutting inserts) that exhibit a microstructure that results in better physical properties and performance characteristics.

The specification contains many descriptions that disprove the Examiner's position that (see Office Action at page 3, lines 18-21):

> It is unclear how simply heating the ground insert to a temperature within the claimed range after the insert has been ground would provide any structural difference between the claimed article and that of the prior art. In the

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alternative, if there is any difference, the difference must be minor and obvious.

Selected relevant portions of the specification are set forth in Table A below.

Table A
Selected Listing of Advantages Connected with the
Ground and Heat Treated Ceramic Cutting Insert

Citation to the Specification	Brief Description
Test No. 1, Table IV. Page 15, line 34 through page 16, line 2	For fly cut milling Class 40 Gray Cast Iron (GCI), the tool life as measured in minutes for the ground and heat treated cutting inserts of Mixture I was about two and one-half times as great as that for the ground surface cutting inserts of Mixture I.
Test No. 2, Table IV. Page 16, lines 3-11.	For a turning cycle test on Class 40 Gray Cast Iron, the ground and heat treated cutting insert had improved tool life of about twenty-seven percent (39.2 cycles/30.8 cycles) over the unground surface cutting insert and an improved tool life of about thirty-six percent (39.2 cycles/ 28.8 cycles) over the ground surface cutting insert.
Tests Nos. 3 and 4, Table IV. Page 16, lines 12-22.	For the turning of Class 30 Gray Cast Iron brake rotors, Test No. 3 shows nose wear for ground and heat treated cutting insert was eighteen percent less than ground cutting insert; and Test No. 4 shows that the average nose wear for the ground and heat treated cutting insert was about the same as for the ground surface cutting insert.
Test No. 5, Table IV. Page 16, line 23 through page 17, line 2.	For a turning cycle test on Class 40 Gray Cast Iron, there was a twenty-seven percent improvement in the tool life (12.7 minutes/10.0 minutes) in the turning of gray cast iron, as measured by minutes, between the ground surface cutting insert and the ground and heat treated cutting insert.
Tests Nos. 6 and 7, Table IV. Page 17, lines 3-11.	For the continuous turning of a round bar of ductile cast iron (80-55-06), the tool life was about the same for the cutting inserts in a continuous turning test.
Test No. 8, Table IV. Page 17, lines 12-26.	For the fly cut milling of Class 40 Gray Cast Iron (GCI), the tool life for the ground and heat treated cutting insert was about twenty percent (1.8 minutes/ 1.5 minutes) better than that for the ground surface cutting insert of Mixture IV.

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The intrinsic evidence in the specification (Ser. No. 10/606,482) establishes advantages connected with the cutting insert of the claims as compared to the prior art. Hence, to the extent there is any burden on applicants to establish differences over the prior art, applicants have done so via test results in the specification.

In reference to Jindal et al., the Citation by the Examiner is a part of EXAMPLE 6, which reads at Col. 8, lines 47-67:

> Several ceramic metal cutting inserts, styles SNGA-433, having approximately 5.0 v/o SiC_w, 10 v/o zirconia, 0.5 v/o magnesia and the remainder Al_2O_3 as produced in accordance with U.S. Pat. No. 4,959,331; were ground to a fine surface finish, visually evaluated by the use of a die penetrant, and the ultrasonically cleaned as previously described. The inserts were then individually heated in separate test runs for approximately four hours to a temperature of approximately 400° C. followed by one-half hour of ion etching at a pressure of approximately 10^{-3} torr in a Balzers BAI 830 system. An initial layer of titanium was then coated to the insert surface by applying an arc current of approximately 125 amps over a period of approximately five minutes to the titanium within the crucible as the crucible moved vertically upward within the vacuum chamber and then applying an arc current of approximately 200 Amps for approximately five minutes as the crucible moved moved vertically downward within the vacuum chamber. Nitrogen gas was then introduced into the system for about 90 minutes to form a titanium nitride coating on the insert surface.

The heat treatment after grinding is intended to prepare the surface of the cutting insert for PVD coating. In this regard, Jindal et al. reads at Col. 2, lines 34-40:

> The process involves cleaning the nonconductive substrate surfaces and then depositing by physical vapor deposition a first layer of a refractory metal such

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> as titanium and then depositing a second layer of a refractory metal compound such as titanium nitride to produce a coated nonconductive substrate having enhanced coating adhesion.

This text clearly states that cleaning is a part of the Jindal et al. invention. Jindal et al. then reads at Col. 5, lines 1-11 [emphasis added by author]:

> **The ceramic substrate is then cleaned by heating and ion-etching.** The ceramic substrate may be heated by any suitable means known in the art, such as electron bombardment. In electron bombardment, a positive potential is placed on the substrate within the chamber to attract electrons from the gaseous plasma. Under a vacuum of approximately 10^{-3} torr, the substrate is heated by the electrons striking the substrate surface thereby removing various oxides from the substrate surface. The Si--Al--ON based substrate and the Al_2O_3 based substrate are preferably heated to at least a temperature of approximately 400 °C.

The text shows that the 400 °C treatment helps clean the surface of the cutting insert to prepare the cutting insert for PVD coating.

Keeping the purpose of the post-grinding cleaning treatment of Jindal et al. in mind, one cannot properly expand the 400 °C cleaning treatment to encompass a heat treating step with a temperature equal to 1600-2200 °C, which is a sintering temperature and not a cleaning temperature in the sense of Jindal et al. The fact that Suzuki discloses sintering temperatures cannot justify the elevation of the temperature of the Jindal et al. cleaning step a minimum of four times. As set forth in Table A hereof, applicants strongly advance the position that the post-grinding heat treatment results in advantages for the ceramic cutting insert.

Applicants have shown that the post-grinding heat treatment of claim 25 is NOT the same as just any heat treatment, and that such step produces advantages. See Table A herein.

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Hence, the Examiner cannot take Jindal et al.'s low temperature cleaning step and elevate the temperature to be within the claimed temperature range.

Applicants submit that claim 25 is patentable over the combination of Jindal et al. and Suzuki for the reason set forth above.

In regard to claims 26-28 and 31-34, each one of these claims depends in one fashion or another from claim 25, and hence, is allowable for the reasons advanced in support of the allowance of claim 25.

For the above reasons, applicants submit that the rejections lack merit and solicit the removal thereof along with the allowance of the claims.

Rejection of Claims 30 and 56 under 35 USC §103(a) over Jindal et al. in view of Moriguchi et al.

The Examiner rejects claims 30 and 56 under 35 USC §103(a) over Jindal et al. in view of Moriguchi et al. Applicants submit that claims 30 and 56 are allowable for the reasons set forth below.

The Examiner uses the portion of Jindal et al. that deals with the heat treatment of a ground cutting insert. The Examiner then attempts of combine Jindal et al. with a document (i.e., Moriguchi et al.) that specifically avoids grinding of the cutting insert. In fact, Moriguchi et al. reads (Col. 3, lines 47-52):

> It is an object of the present invention to provide a tool or insert of a silicon nitride sintered body and a tool or insert of a surface-coated silicon nitride sintered body, each of which has excellent wear resistance as well as toughness by improving the surface state of the silicon nitride sintered body without grinding.

Applicants submit that the combination is improper in light of this difference that is more in kind than even degree. It is improper to combine a ground-heat treated document (i.e., Jindal

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et al.) with a non-ground document (Moriguchi et al.) to arrive at the claimed invention of claims 30 and 56.

Finally, claims 30 and 56 depend in one fashion or another from claim 25, and is allowable for the reasons advanced in support of claim 25. Applicants solicit the removal of the rejection and the allowance of claims 30 and 56.

Rejection of Claims 25-28, 30 and 56 under 35 USC §103(a) over JP'174

The Examiner rejects claims 25-28, 30 and 56 under 35 USC §103(a) over JP'174 (JP 04-136174). Applicants submit that these claims are allowable for the reasons set forth below.

Claim 25 reads [in part] that, "...heat treating the ground ceramic cutting insert at a temperature between about 1600 degrees Centigrade and about 2200 degrees Centigrade so as to form the heat treated ground ceramic cutting insert." The lower limit of the temperature range is now "about" 1600 °C. Applicants contend that the lower limitation has significance vis-à-vis JP'174 since JP'174 expressly discourages a heat treatment above 1400 °C. In this regard, the English translation of JP'174 reads [in part]:

> Furthermore, in this inventive method the heating temperature of the heat treatment is set at 1050~1400 °C because at temperatures below 1050 °C crystallization of the glass phase is inadequate, and as a result the desired effect of improving adhesion with the hard coating is not obtained. On the other hand, if the temperature exceeds 1400 °C it causes a breakdown reaction in the sialon or Si_3N_4 that is the main component of the matrix, and tool strength decreases.

This text establishes that JP'174 cannot extend its reach for prior art purposes past 1400 °C. For this reason, claim 25, which has a lower limit to the temperature range equal to about 200°C above the maximum temperature of 1400 °C, is allowable over JP'174.

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Claims 26-28, 30 and 56 depend in one fashion or another from claim 25, and hence, are allowable for the reasons advanced in support of claim 25.

Claim 57

The summary of the pending Office Action (mailed November 15, 2007) indicates that claim 57 stands rejected; however, the detailed action does not address claim 57. Claim 57 calls for a composition comprising alumina, silicon carbide whiskers and titanium carbonitride. This claim finds support in Table II (Mixture VI) in the specification. None of the applied references addresses the titanium carbonitride-based ceramic cutting insert. Claim 57 should be allowable.

Conclusion

For the above reasons, applicants solicit the removal of the rejections and request allowance of the claims. In this regard, applicants submit:

(1) that it is an impressible expansion of the Jindal et al. disclosure to quadruple the 400 °C heat treatment step to encompass the claimed temperature range for the heat treatment (i.e., "... heat treating the ground ceramic cutting insert at a temperature between about 1600 degrees Centigrade and about 2200 degrees Centigrade so as to form the heat treated ground ceramic cutting insert.";

(2) that it is improper to combine Jindal et al. with Moriguchi et al. since one pertains to a ground cutting insert and the other expressly avoids grinding the cutting insert; and

(3) that the Examiner must appreciate that JP'174 excludes heat treating at a temperature greater than 1400 degrees Centigrade, and thus, cannot address

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claim 25, which now has a lower limit of about 1600 °C, which is about 200 °C higher than the maximum temperature taught by JP'174.

If the Examiner disagrees with the above arguments, but has suggestions to place the claims in form for allowance, applicants urge the Examiner to contact the undersigned attorney (615-662-0100) or Mr. John J. Prizzi, Esq. (724-539-5231) to discuss the claims.

Respectfully submitted,

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